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REVISION OF FACTORISATION

Factorisation is the process of writing an expression as a **product** of its **factors**.

Factorisation is the reverse process of expansion, so we use the expansion laws in reverse.

FACTORISING WITH COMMON FACTORS

If every term in an expression has the same common factor, then we can place this factor in front of a set of brackets. We use the reverse of the distributive law for expansion.

Example 8

 Self Tutor

Fully factorise:

a $6x^2 + 4x$

b $-4(a + 1) + (a + 2)(a + 1)$

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b $-4(a + 1) + (a + 2)(a + 1)$

a

$$\begin{aligned} & 6x^2 + 4x \\ &= 2 \times 3 \times x \times x + 2 \times 2 \times x \\ &= 2x(3x + 2) \end{aligned}$$

b

$$\begin{aligned} & -4(a + 1) + (a + 2)(a + 1) \\ &= (a + 1)[-4 + (a + 2)] \\ &= (a + 1)(a - 2) \end{aligned}$$

DIFFERENCE OF TWO SQUARES FACTORISATION

$$a^2 - b^2 = (a + b)(a - b)$$

Example 9

 Self Tutor

Fully factorise:

a $4 - 9y^2$

b $9a - 16a^3$

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$$a^2 - b^2 = (a + b)(a - b)$$

Example 9



Fully factorise:

a $4 - 9y^2$

b $9a - 16a^3$

a

$$\begin{aligned} & 4 - 9y^2 \\ &= 2^2 - (3y)^2 \\ &= (2 + 3y)(2 - 3y) \end{aligned}$$

b

$$\begin{aligned} & 9a - 16a^3 \\ &= a(9 - 16a^2) \\ &= a(3^2 - (4a)^2) \\ &= a(3 + 4a)(3 - 4a) \end{aligned}$$

PERFECT SQUARES FACTORISATION

$$a^2 + 2ab + b^2 = (a + b)^2$$

$$a^2 - 2ab + b^2 = (a - b)^2$$

Example 10



Factorise:

a $4x^2 + 4x + 1$

b $8x^2 - 24x + 18$

a

$$\begin{aligned} &4x^2 + 4x + 1 \\ &= (2x)^2 + 2 \times 2x \times 1 + 1^2 \\ &= (2x + 1)^2 \end{aligned}$$

b

$$\begin{aligned} &8x^2 - 24x + 18 \\ &= 2(4x^2 - 12x + 9) \\ &= 2((2x)^2 - 2 \times 2x \times 3 + 3^2) \\ &= 2(2x - 3)^2 \end{aligned}$$

1 Fully factorise:

a $x^2 - 5x$

b $2x^2 + 6x$

c $4x - 2xy$

d $3ab - 6b$

e $2x^2 + 8x^3$

f $-6x^2 + 12x$

g $x^3 + x^2$

h $3ab^2 - 9a^2b$

2 Fully factorise:

a $3(x + 5) + x(x + 5)$

b $a(b + 3) - 5(b + 3)$

c $x(x + 4) + x + 4$

d $x(x + 2) + (x + 2)(x + 5)$

e $a(c - d) + b(c - d)$

f $y(2 + y) - y - 2$

g $ab(x - 1) + c(x - 1)$

h $a(x + 2) - x - 2$

i $(x - 3)^2 + x - 3$

j $(x + 5)^2 + 3x + 15$

k $2(x - 2)^2 + 4x - 8$

l $(x + y)^3 - x - y$

3 Fully factorise:

a $x^2 - 16$

b $64 - x^2$

c $9x^2 - 1$

d $49 - 4x^2$

e $y^2 - 4x^2$

f $4a^2 - 25b^2$

g $81x^2 - 16y^2$

h $4x^4 - y^2$

i $9a^2b^2 - 16$

j $(x + 3)^2 - 4$

k $(3x - 2)^2 - 16$

l $(2x - 5)^2 - (x - 4)^2$

4 Fully factorise:

a $2x^2 - 8$

e $a^3b - ab^3$

b $3y^2 - 27$

f $50 - 2x^2y^2$

c $2 - 18x^2$

g $9b^3 - 4b$

d $4x - 9x^3$

h $x^5 - xy^4$

5 Factorise:

a $x^2 + 4x + 4$

d $x^2 - 8x + 16$

b $x^2 - 10x + 25$

e $4x^2 + 28x + 49$

c $9x^2 + 30x + 25$

f $x^2 - 20x + 100$

6 Factorise:

a $-9x^2 + 6x - 1$

d $2x^2 - 50$

b $3x^2 + 18x + 27$

e $2x^2 - 16x + 32$

c $-18x^2 + 12x - 2$

f $-3x^2 - 18x - 27$

- 1** **a** $x(x - 5)$ **b** $2x(x + 3)$ **c** $2x(2 - y)$
d $3b(a - 2)$ **e** $2x^2(1 + 4x)$ **f** $6x(2 - x)$
g $x^2(x + 1)$ **h** $3ab(b - 3a)$
- 2** **a** $(x + 5)(3 + x)$ **b** $(b + 3)(a - 5)$ **c** $(x + 4)(x + 1)$
d $(x + 2)(2x + 5)$ **e** $(c - d)(a + b)$ **f** $(2 + y)(y - 1)$
g $(x - 1)(ab + c)$ **h** $(x + 2)(a - 1)$ **i** $(x - 3)(x - 2)$
j $(x + 5)(x + 8)$ **k** $2x(x - 2)$
l $(x + y)(x + y + 1)(x + y - 1)$
- 3** **a** $(x + 4)(x - 4)$ **b** $(8 + x)(8 - x)$
c $(3x + 1)(3x - 1)$ **d** $(7 + 2x)(7 - 2x)$
e $(y + 2x)(y - 2x)$ **f** $(2a + 5b)(2a - 5b)$
g $(9x + 4y)(9x - 4y)$ **h** $(2x^2 + y)(2x^2 - y)$
i $(3ab + 4)(3ab - 4)$ **j** $(x + 5)(x + 1)$
k $3(3x + 2)(x - 2)$ **l** $3(x - 3)(x - 1)$
- 4** **a** $2(x + 2)(x - 2)$ **b** $3(y + 3)(y - 3)$
c $2(1 + 3x)(1 - 3x)$ **d** $x(2 + 3x)(2 - 3x)$
e $ab(a + b)(a - b)$ **f** $2(5 + xy)(5 - xy)$
g $b(3b + 2)(3b - 2)$ **h** $x(x^2 + y^2)(x + y)(x - y)$
- 5** **a** $(x + 2)^2$ **b** $(x - 5)^2$ **c** $(3x + 5)^2$ **d** $(x - 4)^2$
e $(2x + 7)^2$ **f** $(x - 10)^2$
- 6** **a** $-(3x - 1)^2$ **b** $3(x + 3)^2$ **c** $-2(3x - 1)^2$
d $2(x + 5)(x - 5)$ **e** $2(x - 4)^2$ **f** $-3(x + 3)^2$